

SECTION J, PART 0
OPERATIONS COMMON TO ALL
CLASS OF TESTS

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J OPERATIONS COMMON TO ALL CLASS OF TESTS

Part J0 covers flowcharts for trouble analysis and simplified block flowcharts for test and monitor functions. Block flowcharts are used to show the flow of a specific test and also show how one type of test might have functions common to other test. Information in the block flowchart directs the reader to a part of the test volume (SFD 10-01 J-P) where the sequence chart and/or functional schematics are shown.

Monitoring incorporates both service and test circuits, utilizing to a large degree the service circuits, and reference will be made to service and test SFD parts (SFD 10-01 B-D and SFD 10-01 J-P).

Part J1 covers master test control and master test frame connector seizure.

J0 BLOCK FLOWCHARTS

Block flowcharts are used to show the flow of a test and also show how one type of test might have functions common to other test. The following paragraphs discuss in general terms the types of test found in the test SFD.

J0-1 MARKER CLASS OF TESTS

Three general marker class of tests are provided wherein the MTC circuit simulates the three types of marker seizure by directing the connection to the desired marker via the MTFC. These classes are the DT, ORIG, and INC. In making marker tests, the marker is primed with information set up on keys and switches of the MTC and closed through on leads corresponding to those of the circuit which the test circuit is simulating. The marker being tested functions in accordance with the information with which it is primed, makes required translations, connects to line and TL, number group, registers, and senders as required, and sets up connections through linkages in as nearly a normal manner as is consistent with avoiding interference with service. Thus in testing a marker, the functions of the frames and circuits to which it connects are also tested. The marker is prevented from operating the line hold magnets; instead, the operation of the line hold magnet is simulated by the test frame.

If the marker encounters a trouble during a test, it calls in the trouble recorder to take a record after which it functions as it would in service to complete the connections or to give a trouble release.

If the REC key is operated the marker is blocked just before it starts to release the connecting circuits and a record is taken on the trouble recorder of the progress, keyed information, route, and connecting circuits involved.

Upon receiving a regular or trouble release from the marker, the MTC lights a corresponding lamp and releases the MTFC and the marker.

J0-2 PRETRANSLATOR CLASS OF TEST

Pretranslator class of test (PTT) provides means wherein the MTC can direct a connection via the MTFC to the particular Pretranslator (PRT) to be tested. In making pretranslator tests, the PRT is primed with information set up on keys and switches of the MTC and closed through on leads corresponding to those of an OR which the test circuit simulates. The PRT being tested, translates the information received and transmits the results back to the test circuit where it is displayed on lamps.

Trouble conditions which would produce a trouble record in service will also produce a trouble record on the test call. No provision is made to force a trouble record on satisfactory calls because the results of such tests are displayed on lamps.

J0-3 REGISTER SENDER TESTING

The L section covers testing registers and senders using the MTC circuit and Automatic Monitor Register Sender Test (AMRST) circuit. Primary control of these tests is in the MTC. The digits to be dialed are set on the keys or switches in that circuit. The tests to be made on the registers and senders are under control of the keys in the AMRST which are preoperated. The MTC also connects the originating test line to the AMRST to simulate a subscriber. The pulsing performance and other tests of the registers and senders are made and checked by the AMRST and if completed satisfactorily an OK signal is indicated.

J0-4 TRUNK TESTING

The M section covers testing trunks using the MTC circuit and Trunk Test Circuit (TTC).

Several classes of trunk tests can be performed from the MTC to test essentially all types of trunks in the No. 5 Crossbar office and incoming trunks in the distant connecting office. In general the MTC directs the marker to set up a connection to the trunk to be tested and the TTC performs the test. The different types of trunk tests are described below.

The OGT class of trunk test is used for testing outgoing trunks which require senders. A connection is set from the originating test line to the trunk under test. The TT relay of the trunk circuit is operated to transfer the outgoing tip and ring leads back to the TTC via the trunk test multiple. The TTC thus has control of both ends of the connection.

The IAO class of trunk test is used for testing intraoffice trunks. A connection is set from the originating test line to the terminating test line. The TTC thus has control of both ends of the connection.

The MISC class of trunk test is designed for testing miscellaneous type of trunks that are not furnished with TT relays but are selected by marker mate relays. The MISC class is also used to test regular types of outgoing trunk circuits when it is not desired to operate the TT relay. A connection is set from the originating test line and the termination depends on the type of trunk and the directory digits set on the A- to K- keys or switches.

The ITDO class of trunk is used for testing certain features of incoming trunks in distant offices. A connection is established from the originating test line to an outgoing trunk. The call is directed to a test line in the distant office. The TT relay of the outgoing trunk is operated, but the tip and ring leads are extended back through the trunk test multiple to the trunk facility. The CS lead from the trunk through the trunk TT relay and the trunk test multiple allows supervision from the distant end to be monitored.

The ITNP class of trunk test is used for testing incoming trunks. A patch cord connection is made from the TTC to the trunk under test. The marker is then directed to set a connection from the incoming trunk to the terminating test line. The TTC thus has control of both ends of the connection.

J0-5 SUBSCRIBER LINE TEST AND MARKER LINE VERIFICATION CLASS OF TEST

(A) Subscriber Line Test

The Line Test (LT) class of test is used to set up a connection from the master test frame voltmeter test circuit to any line to be tested. The MTC simulates a no-hunt incoming trunk that has an appearance on a

trunk link. The MTC also simulates an incoming register and extends the trunk to the master test frame voltmeter test circuit where tests for talking, ringing, foreign potentials, capacity tests, receiver off hook tone and continuity tests may be made.

(B) Marker Line Verification

The MLV class of test is used to verify the cross connections in the number group and class of service cross-connections in the LL for any line and for intercept and similar trunks to which an arbitrary class of service and line number have been assigned.

J0-6 MONITORING

In monitoring, the AMRST circuit is associated with registers and senders and independently records the number pulsed into a register or out of a sender. This number is compared with the number the register sends to the marker or the number the sender receives from the marker. If these numbers do not agree, a trouble record card is perforated identifying the circuit which was monitored and giving other information relative to the trouble. If the numbers agree, the monitor releases. In either case, the service call is not affected.

There are 3 basic modes of monitoring:

- (1) For progressive monitoring the monitor is arranged to monitor successively on originating registers, outgoing senders, and incoming registers.
- (2) For a particular type the monitor is arranged to monitor originating registers only, outgoing senders only or incoming registers only.
- (3) For a particular circuit the monitor is arranged to monitor on a particular OR, outgoing sender, or IR.

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J1 MASTER TEST CONTROL AND MASTER TEST FRAME CONNECTOR SEIZURE

The MTC circuit is used to test markers and connecting circuits, and pretranslators. The MTC is used to control setting up of tests of outgoing senders, OR or IR made by the AMRST, to control setting up of tests of trunks made by the TTC, to verify cross-connections associated with a subscriber line and to set up connections to any line for tests from the voltmeter test circuit.

Although the MTC has facilities to test other features such as AMA and CENTREX, it is not the intent of this volume to illustrate these features but they will be covered in another volume.

The MTFC connects markers, PRT, the AMRST, and the Line Insulation Test Control (LITC) circuit to the trouble recorder for trouble records. It also connects the MTC to markers, and pretranslators for test calls and to markers for line verification tests. If trouble is encountered on these calls or if a record of a properly completed marker test call is to be made, the MTFC connects to the trouble recorder. In addition, connection is made through the MTFC when connection is made between AMRST and completing markers for monitor and test calls.

J1-0 DIAL TONE CLASS-OF-MARKER TEST

J1-0.1 GENERAL

On a DT class marker test, the MTC simulates those parts of a LL which function with the marker through the LLMC. The marker is primed with a line equipment location and proper closure is made on required control leads whereupon the marker proceeds to select an idle OR and to set up a connection to it from the simulated originating line location.

J1-0.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-0.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the Start Test (ST) relay which operates the selected class of test relay, in this case DT relay (SFD-J103-J104).

With the DT key operated (SFD-J104), or the TSTA switch in the DT position (SFD-J103) operation of the ST relay operates the DT relay. Operation of the DT relay lights the DT or STT lamp and operates the MS (simulates marker start relay in LLMC) relay. The MS relay operates MS1 relay (SFD-J106).

The DT relay also transfers control of the MTFC start battery lead MTP to the MS1 relay (SFD-J108 or J112).

When the DT or STT lamp lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the Marker Test (MKT1) relay allowing it to operate in series with the previously operated class-of-test relay DT (SFD-J104). The MKT1 relay operates the MKT2, 3 relays (SFD-J106). Operation of the MKT2 relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay closes the path to operate the N1 relay (which checks AMRST and TT are normal). The MKT1 relay operates the KCH (connect channel selection) relays (SFD-J106), and furnishes ground to MTPT lead for subsequent perforation of MTPT indication (marker and pretranslator test) when a trouble record is taken of the test call after MC3 relay operates (SFD-K104).

J1-0.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead (SFD-J108, J112) and to the traffic register PCT lead to operate a register which counts the number of tests made.

J1-0.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J108) operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT (0-11) and through the make contact of the first operated MT (0-11) key (or through one position of the MT or MTU switch) to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J121), and grounds the TS lead to

the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the Key Release (KR) relay to restore the test circuit and connector to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-0.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP when all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J121), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-0.5 SELECTION OF A MARKER

The MKT1(-) relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TM1 relay (SFD-J118).

When the CIT relay operates (SFD-J117) it connects the marker MIT lead through MKT1(-) relay operated and the TS relay normal to the winding of the TM relay in the MTFC. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TM1 relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-0.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases, the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through operated MKT1(-) relay to operate MKB2(-) relay. The MKB2(-) relay operates the MTFC connector relays (SFD-J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-0.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS relay operates the KMT9 operates in turn operating the KTS (SFD-J107).

J1-0.8 PROGRESS AND IDENTIFICATION LAMP CONTROL

If it is desired to observe what frames are seized by the marker, the LP(0-11) key or LP switch, corresponding to the MT(0-11) key (or position

of the MT or MTU switch) should be operated (SFD-J124). This causes lamps, associated with the various frames and connectors seized by the marker under test, to light. It may be desirable to make the marker busy to avoid lighting lamps for service calls handled by the marker between test calls.

The LP keys or LP switch provides means for controlling the progress and identification lamps of the jack, lamp, and key circuit so that lamps for the number group, TL, LL, and sender connectors can be lighted either by all markers or by any one marker.

A relay in each marker is provided which furnishes grounds through normal contacts to the connectors associated with the controlled lamps. When all keys are in or LP switch is in the OFF position, the relays in all markers are normal and lamps for the various connectors light when the connectors are seized by any marker. When any one key is pulled out or LP switch is operated, the relays of all markers, except the one associated with this key, operate. The connector lamps then light only when the connector is seized by this marker.

On some types of calls, the holding time of the number group and the LL is so short that the associated frame lamps do not light adequately.

When any of the LP(0-11) keys are pulled out or LP switch is operated, the LP relay in the MTC operates along with the LP relays of all markers except the one associated with this LP key or switch. This substitutes +130 volt battery through a resistor and parallel capacitor for the ground normally used to light the number group and LL lamps. The value of the resistance is such that the steady state voltage on the lamps is approximately 50 volts. However, at the instant the circuit is closed approximately 180 volts is applied to the lamp. This voltage quickly drops to 50 volts as the capacitor charges but causes a booster shot of current through the lamp to heat it quickly. When the circuit to the lamp is opened, the capacitor discharges through the resistance and becomes ready for its next booster shot.

Only one LP key at a time should be pulled out because if two or more markers attempt to operate the same frames at the same time, two or more lamps in parallel would be connected in series with the booster and would not light satisfactorily.

J1-1 ORIGINATING CLASS-OF-MARKER TEST

J1-1.1 GENERAL

On an ORIG class of marker test, the MTC simulates an OR. The marker is primed with code and digits, originating line location, class of service, and other information which it would normally receive from an OR, whereupon

normally receive from an OR, whereupon the marker proceeds to function in accordance with its translation of the information received to set up a connection from the originating line location to an outgoing trunk without a sender.

J1-1.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-1.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated ORIG key or TSTA switch (ORIG) in that chain extends the ground to the ORIG relay which operates.

With the ORIG key operated or the TSTA switch in the ORIG position, operation of the ST relay operates the ORIG relay. The operated ORIG relay lights the ORIG or STT lamp.

When the ORIG or STT lamp lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the MKT1 relay allowing it to operate in series with the previously operated class-of-test relay ORIG. The MKT1 relay operates the MKT2 and MKT3 relays (SFD-J106). Operation of the MKT2 operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay closes the path to operate the N1 relay (which checks AMRST and TT are normal). The MKT1 relay operates the KCH (connect channel selection) relays (SFD-J106), and furnishes ground to MTPT lead for subsequent perforation of MTPT indication (marker and pretranslator test) when a trouble record is taken of the test call after MC3 relay operates (SFD-K104).

J1-1.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-1.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay Marker Test Preference (MTP). If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT- preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided, to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-1.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP (marker test preference) where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-1.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller.

The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TMI relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TMI relay allowing the test call to proceed.

J1-1.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TMI relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TMI relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120, J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-1.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-1.8 PROGRESS AND IDENTIFICATION LAMP CONTROL

If it is desired to observe which frames are seized by the marker, the LP(0-11) key or LP switch, corresponding to the MT(0-11) key (or position of the MT or MTU switch) should be operated (SFD-J124). This causes lamps, associated with the various frames and connectors seized by the marker under test, to light. It may be desirable to make the marker busy to avoid lighting lamps for service calls handled by the marker between test calls.

The LP keys or LP switch provides means for controlling the progress and identification lamps of the jack, lamp, and key circuit, so that lamps for the number group, TL, LL, and sender connectors can be lighted either by all markers or by any one marker.

A relay in each marker is provided which furnishes grounds through normal contacts to the connectors associated with the controlled lamps. When all keys are in or LP switch is in the OFF position, the relays in all markers are normal and lamps for the various connectors light when the connectors are seized by any marker. When any one key is pulled out or LP switch is operated, the relays of all markers, except the one associated with this key, operate. The connector lamps then light only when the connector is seized by this marker.

On some types of calls, the holding time of the number group and the LL is so short that the associated frame lamps do not light adequately.

When any of the L0(0-11) keys are pulled out or LP switch is operated, the LP relay in the MTC operates along with the LP relays of all markers except the one associated with the LP key or switch. This substituted +130 volt battery through a resistor and parallel capacitor for the ground normally used to light the number group and line link frame lamps. The value of the resistance is such that the steady state voltage on the lamps is approximately 50 volts. However, at the instant the circuit is closed approximately 180 volts is applied to the lamp. This voltage quickly drops to 50 volts as the capacitor charges, but causes a booster shot of current through the lamp to heat it quickly. When the circuit to the lamp is opened, the capacitor discharges through the resistance and becomes ready for its next booster shot.

Only one LP key at a time should be pulled out, because if two or more markers attempt to operate the same frames at the same time, two or more lamps in parallel would be connected in series with the booster and would not light satisfactorily.

J1-2 INCOMING CLASS-OF-MARKER TEST WITH OR WITHOUT TAN CLASS

J1-2.1 GENERAL

On an incoming class-of-marker test, the MTC simulates an incoming trunk and an incoming register. The marker is primed with a called number, TL number, and other information which it would normally receive from an incoming register, whereupon it proceeds to function in accordance with its translation of the information received to set up a connection from the called line location to the TL on which the simulated trunk is made to seem to appear. Operation of hold magnets on the TL is simulated.

On an incoming class-of-marker test with TAN class, the MTC simulates an incoming tandem trunk and incoming register. The CM is primed with a called number, tandem trunk number and even/odd connector position in the IRMC which it would normally receive from the incoming register. With this information, the CM proceeds to function in accordance with its translation of the information received to set up a connection from the line location of a simulated tandem incoming trunk to an outgoing trunk arranged for tandem operation.

J1-2.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-2.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated INC key or TSTA switch (INC) in that chain extends the ground to the INC relay which operates.

With the INC key or TSTA switch in the INC position, operation of the ST relay operates the INC relay, lighting the INC or STT lamp.

For TAM class, when the ST key, the MTC functions as it would normally except that upon operation of the KIC relay (SFD-K117), the KTN and KTN1 relays are operated (SFD-K117) to close through the trunk number and odd/even connector signal set up on the MTC.

When the INC or STT lamp lights the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the MKT1 relay in the MTC allowing it to operate in series with the previously operated class-of-test relay INC. The MKT1 relay operates the MKT2 and MKT3 relays (SFD-J106). Operation of these relays opens the ST ground path to prevent subsequent operation of the ST key from shunting down the MKT1 relay, operates the N1 and KCH relays, and furnishes ground for MTPT lead for subsequent perforation of MTPT indication (marker and pretranslator test) when a trouble record is taken of the test call and operates the TKS relay.

J1-2.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead and to the traffic register PCT lead to operate a register which counts the number of tests made.

J1-2.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP (marker test preference). If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT- preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided, to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR (key release) relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-2.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP (marker test preference) when all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends

back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-2.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TM1 relay (SFD-J118).

When the CIT relay operates (SFD-J117) it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TM1 relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through

normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM relay allowing the test call to proceed.

J1-2.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120, J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-2.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-2.8 PROGRESS AND IDENTIFICATION LAMP CONTROL

If it is desired to observe what frames are seized by the marker, the LP(0-11) switch corresponding to the position of the MT or MTU should be operated. This causes lamps, associated with the various frames and connectors seized by the marker under test, to light. It may be desirable to make the marker busy to avoid lighting lamps for service calls handled by the marker between test calls.

The LP keys or LP switch provides means for controlling the progress and identification lamps of the jack, lamp, and key circuit so that lamps for the number group, TL, LL, and sender connectors can be lighted either by all markers or by any one marker.

A relay in each marker is provided which furnishes grounds through normal contacts to the connectors associated with the controlled lamps. When all keys are in or LP switch is in the OFF position, the relays in all markers are normal and lamps for the various connectors light when the connectors are seized by any marker. When any one key is pulled out or LP switch is operated, the relays of all markers except the one associated with this key operate. The connector lamps then light only when the connector is seized by this marker.

On some types of calls, the holding time of the number group and the LL is so short that the associated frame lamps do not light adequately.

When any of the LP(0-11) keys are pulled out or LP switch is operated, the LP relay in the MTC operates along with the LP relays of all markers except the one associated with the LP key or switch. This substitutes +130 volt battery through a resistor and parallel capacitor for the ground normally used to light the number group and LL lamps. The value of the resistance is such that the steady state voltage on the lamps is approximately 50 volts. However, at the instant the circuit is closed approximately 180 volts is applied to the lamp. This voltage quickly drops to 50 volts as the capacitor charges but causes a booster shot of current through the lamp to heat it quickly. When the circuit to the lamp is opened, the capacitor discharges through the resistance and becomes ready for its next booster shot.

In older offices with the LP keys only one LP key at a time should be pulled out because, if two or more markers attempt to operate the same frames at the same time, two or more lamps in parallel would be connected in series with the booster and would not light satisfactorily.

J1-3 ORIGINATING REGISTER TEST USING AMRST

The L1 section of the SFD covers seizure of the AMRST to test OR, OS, and IR. Sequence chart L102-L104 make reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above tests. Paragraphs J1-3 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the AMRST and covered on sequence chart L102 have operated.

J1-3.1 GENERAL

On an OR class of test the MTC connects to the AMRST and, after determining that it is ready for a test, gives the AMRST a start signal and proceeds to connect to a Dial Tone Marker (DTM). The DTM is directed to

set up to a test connection either from an originating test line or through the no test connector to a particular OR. When the DTM has set up the connection to the OR, it returns a release signal to the MTC and is disconnected.

The AMRST proceeds to test the OR. The number to be pulsed into the OR by the AMRST is set up on keys on the MTC. In order to match the number received by the OR against that which was dialed, the AMRST attaches itself to the Completing Marker (CM) to which the OR connects after the number is dialed.

J1-3.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-3.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated, extends ground to a test key or switch chain. The operated OR key or TSTA (OR) switch in that chain extends ground to the corresponding class-of-test relay, which operates.

With the OR key or TSTA(OR) switch operated, operation of the ST relay operates the OR relay. The OR relay operates lights the OR or STT lamp, operates the NTC and NTCL relays if the NTC key is operated, and operates the MS relay from resistance battery.

Releasing the ST key removes the shunting ground from the winding of the SRT1 relay, allowing it to operate in series with the previously operated class-of-test relay OR. The SRT1 relay operates the SRT2 relay. Operation of these relays opens the operate path of the ST relay to prevent subsequent operation of the ST key from shunting down the SRT1 relay (SFD-J103, J104), closes the AV lead to the AMRST for use on controlled advance tests made by the AMRST under control of the ST key (SFD-J103), closes the N lead to the AMRST awaiting a signal that the AMRST is ready to proceed with the test, closes the REP relay operate path over the REP lead from the AMRST for use when REP key is operated to receive a signal from the AMRST to automatically repeat the test (SFD-J107), transfers the SB and TB leads

from the MTFC to the windings of the SB and TB relays to prepare the MTC to recognize a sender-busy or trunk-busy condition, and grounds the SRT lead which is later closed to the MTFC and is used to indicate a sender or register test if a trouble record is taken while the MTC is connected to a marker. The SRT2 relay operates the MTC relay in turn operating the PR relay. The PR relay partially closes the path to operate the N1 relay.

J1-3.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the AMRST is ready to proceed with the test, it closes battery to the N lead to operate the N relay (SFD-J107). The N relay operates the N1 relay which closes start battery to the MTFC (MTP) lead, grounds the STG start lead to the monitor, locks to the KR relay normal, and operates a register over the PCT lead.

J1-3.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J108) operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT (0-11) and through the make contact of the first operated MT (0-11) key (or through one position of the MT or MTU switch) to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J121), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the test circuit and connector to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-3.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP when all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes

connector relays to the marker (SFD-J121), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-3.5 SELECTION OF A MARKER

The MKT1(-) relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TM1 relay (SFD-J118).

When the CIT relay operates (SFD-J117) it connects the marker MIT lead through MKT1(-) relay operated and the TS relay normal to the winding of the TM relay in the MTFC. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TM1 relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-3.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases, the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording

lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through operated MKT1(-) relay to operate MKB2(-) relay. The MKB2(-) relay operates the MTFC connector relays (SFD-J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-3.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS relay operates the KMT9 operates in turn operating the KTS (SFD-J107).

J1-4 OUTGOING SENDER TEST USING AMRST

The L1 section of the SFD covers seizure of the AMRST to test OR, OS, and IR. Sequence chart L102-L104 make reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above tests. Paragraphs J1-4 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the AMRST and covered on sequence chart L103 have operated.

J1-4.1 GENERAL

On an outgoing sender class of test (SDR), the MTC connects to the AMRST and, after determining that it is ready for a test, gives the AMRST a start signal and proceeds to connect to a Completing Marker (CM). The CM is directed to set up a test connection either from an originating test line or through the no-test connector to an outgoing trunk and to connect to that trunk a particular SDR. When the MTC is connected through the MTFC to the CM, it signals the AMRST to also connect to the MTFC so that the MTFC can be provided with information received by the CM from the MTC and transmitted by the CM to the SDR.

When the CM has completed setting up the connection, it gives a release signal to the MTC which releases the CM and MTFC, leaving the connection to the SDR held by the AMRST.

The AMRST matches the called number which is outpulsed by the SDR against the number which was set up in the CM by the MTC.

J1-4.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-4.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break-contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated, extends ground to a test key or switch chain. The operated SDR key or switch in that chain extends ground to the corresponding class-of-test relay, which operates.

With the SDR key or TSTA (SDR) switch operated, operation of the ST relay operates the SDR relay. The SDR relay operated, lights the SDR or STT lamp and grounds the OTT lead to signal the marker to operate the TT relay of the trunk.

Releasing the ST key removes the shunting ground from the winding of the SRT1 relay, allowing it to operate in series with the previously operated class-of-test relay SDR. The SRT1 relay operates the SRT2 relay. Operation of these relays opens the operate path of the ST relay to prevent subsequent operation of the ST key from shunting down the SRT1 relay (SFD-J103, J104), closes the ST lead from the ST key to the AV lead for use on controlled advance tests made by the AMRST under control of the ST key, closes the N lead to the AMRST awaiting a signal that the AMRST is ready to proceed with the test, closes the REP lead for use when the REP key is operated to receive a signal from the AMRST to automatically repeat the test, transfers the SB and TB leads to the windings of the SB and TB relays to prepare the test circuit to recognize a sender-busy or trunk-busy condition, and grounds the SRT lead which is later closed to the MTFC and is used to indicate a sender or register if a trouble record is taken while the MTFC is connected to a marker. The SRT2 relay operates the MTCP relay in turn operating the PR relay. The PR relay partially closes the path to operate the N1 relay.

J1-4.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the AMRST is ready to proceed with the test, it closes battery to the N lead to operate the N relay (SFD-J107). The N relay operates the N1 relay which closes start battery to the MTFC (MTP) lead, grounds the STG start lead to the AMRST, locks to the KR relay normal, and operates a traffic register over the PCT lead.

J1-4.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J108) operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS grounds feeds through break contacts of normal marker selection keys MT (0-11) and through the make contact of the first operated MT (0-11) key (or through one position of the MT or MTU switch) to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the test circuit and connector to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-4.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP when all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT1(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-4.5 SELECTION OF A MARKER

The MKT(-) relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RMI relay (SFD-J123). The RMI relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117) it connects the marker MIT lead through MKT(-) relay operated and the TS relay normal to the winding of the TM relay in the MTFC. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TMI relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TMI relay allowing the test call to proceed.

J1-4.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TMI relay releases, or when the TM relay releases, the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TMI relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through operated MKT(-) relay to operate MKB2(-) relay. The MKB2(-) relay operates the MTFC connector relays (SFD-J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-4.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS relay operates the KMT9 operates in turn operating the KTS (SFD-J107).

J1-5 INCOMING REGISTER TEST USING AMRST

The L1 section of the SFD covers seizure of the AMRST to test OR, OS, and IR. Sequence chart L102-L104 make reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above tests. Paragraphs J1-5 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the AMRST and covered on sequence chart L104 have operated.

J1-5.1 GENERAL

On an IR class of test, the MTC connects to the AMRST and, after determining that it is ready for a test, gives the AMRST a start signal. The AMRST proceeds to set up a connection to the IR. Keys of the MTC are used to control some of the information normally received by the IR through the register link such as incoming class of call. The called number keys or switches of the MTC are used to control the number pulsed into the register by the AMRST. The MTC makes no connection to a marker on this class of test. When the IR has received the required number of digits, it connects to a CM and gives a signal which causes the AMRST to be attached to the marker to match the number pulsed into the IR against the number passed to the CM from the IR.

J1-5.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set

is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-5.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated, extends ground to a test key or switch chain (SFD-J105, J105). The operated IR key or TSTA (IR) switch in that chain extends ground to the corresponding class-of-test relay, which operates.

With the IR key or TSTA(IR) switch operated, operation of the ST relay operates the IR relay. The IR relay operated lights the IR or STT lamp and opens the MTP lead to prevent the test circuit from connecting to a CM through the MTFC (SFD-J106, J108, J112).

Releasing the ST key removes the shunting ground from the winding of the SRT1 relay, allowing it to operate in series with the previously operated class-of-test relay IR (SFD-J104, J105). The SRT1 operates the SRT2 relay. Operation of these relays opens the operate path of the ST relay to prevent subsequent operation of the ST key from shunting down the SRT1 relay (SFD-J103, J104), closes through the AV lead for use on controlled advance tests made by the AMRST, closes the N lead to the AMRST awaiting a signal that the AMRST is ready for test, closes the REP lead for use when the REP key is operated to receive a signal from the AMRST to automatically repeat the test (SFD-J107), transfers the SB and TB leads to the windings of the SB and TB relays to prepare the test circuit to recognize a sender-busy or trunk-busy condition, and grounds the SRT lead which is later closed to the MTFC and is used to indicate a sender or register test if a trouble record is taken while the test circuit is connected to a marker.

When the AMRST is ready to proceed with the test, it operates the N relay. The N relay operates the N1 relay through the operated IR relay which grounds the STG lead to the AMRST and operates the N2 relay.

The operated IR relay opened the MTP lead, preventing the MTC from connecting to a CM. The IR to be tested is selected by the AMRST and the AMRST proceeds to test the IR.

J1-6 OGT CLASS OF TRUNK TEST USING TRUNK TEST CIRCUIT

The M0 section of the SFD covers seizure of the Trunk Test (TT) circuit to test outgoing trunks. Sequence chart M004 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above test. Paragraphs J1-6 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the TT and covered on sequence chart M004 have operated.

J1-6.1 GENERAL

The OGT class of trunk test is used for testing outgoing trunks which require senders. The MTC connects to the TT circuit and signals it to prepare for a test of an outgoing trunk. The MTC simulates an originating class of call and proceeds to connect to a CM which it directs to set up a connection from the originating test line, to the outgoing trunk to be tested.

J1-6.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-6.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated OGT key or TSTB switch (OGT) in that chain extends the ground to the OGT relay which operates.

With the OGT key operated or the TSTB switch in the OGT position, operation of the ST relay operates the OGT relay. The operated OGT relay lights the OGT or STT lamp.

When the OGT or STT lamps lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the Trunk Test (TKT) relay allowing it to operate in series with the previously operated class-of-test relay OGT. The TKT relay operates the TKT1 which operates the TKT2 relay (SFD-J106). Operation of TKT relay opens the ST ground path to prevent subsequent operation of ST key from shunting down the TKT relay. The TKT1 relay extends ground to the TT on the MC lead for later use to signal the TT to close a connecting relay to the MTFC (SFD-M009). The TKT1 relay furnishes ground through the operated OGT relay to operate the OGT relay in the TT. The operated TKT1 relay furnishes resistance battery to operate N relay of the MTC, which partially closes the path to operate the N1 relay. The TKT1 relay operates the MTC relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The TKT1 relay also grounds the STG lead to the TT for operation of the ST relay of the TT (SFD-M009) and closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-6.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-6.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT- preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided), to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-6.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make

contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-6.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RMI relay (SFD-J123). The RMI relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay

circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-6.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-6.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-7 IAO CLASS OF TRUNK TEST USING TRUNK TEST CIRCUIT

The M1 section of the SFD covers seizure of the TT circuit to test intraoffice trunks. Sequence chart M104 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above test. Paragraphs J1-7 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the TT and covered on sequence chart M104 have operated.

J1-7.1 GENERAL

In the IAO class of trunk test the MTC directs a CM to establish a connection from the originating test line to the originating end of the IAO trunk to be tested and from the terminating test line to the terminating end of the IAO trunk. When this connection is established, the TT has control of both ends of the trunk under test and enables the various tests to be performed.

J1-7.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-7.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated IAO key or TSTB switch (IAO) in that chain extends the ground to the IAO relay which operates.

With the IAO key operated or the TSTB switch in the IAO position, operation of the ST relay operates the IAO relay. The operated IAO relay lights the IAO or STT lamp.

When the IAO or STT lamp lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the TKT relay allowing it to operate in series with the previously operated class-of-test relay IAO. The TKT relay operates the TKT1 which operates the TKT2 (SFD-J106). Operation of these relay opens the ST ground path to prevent subsequent operation of the ST key from shunting down the TKT relay. The TKT relay extends ground to the TT on the MC lead for later use to signal the TT to close a connecting relay to the MTFC (SFD-M109). The operated TKT1 relay furnishes resistance battery to operate N relay of the MTC which partially closes the path to operate the N1 relay. The TKT1 relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The TKT1 relay also grounds the STG lead to the TT for operation of the ST relay of the TT (SFD-M109) and closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-7.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-7.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT- preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided, to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR (key release) relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-7.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-7.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller.

The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TM1 relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TM1 relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-7.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120,) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-7.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-8 MISC CLASS OF TRUNK TEST USING TRUNK TEST CIRCUIT

The M2 section of the SFD covers seizure of the TT circuit to test miscellaneous class of trunks. Sequence chart M204 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above tests. J1-8 paragraphs of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the TT and covered on sequence chart M204 have operated.

J1-8.1 GENERAL

The MISC class of trunk test is primarily designed for testing miscellaneous types of trunks that are not furnished with TT relays but are selected by marker route relays. The MISC class of test is also used to test regular types of outgoing trunk circuits when the TT relays are not operated.

The MTC connects to the TT, signals the TT to prepare for miscellaneous class of test, and after receiving a signal that the TT is normal, grounds its start lead and proceeds to connect to a CM which, in turn, is directed to set up a connection from the originating test line to the trunk to be tested.

On MISC class of test the TT does not instruct the CM to operate the TT relay in outgoing trunks, and does not instruct the CM to give a no digit signal to senders. The connection is completed to a terminating office as directed by the dialed digits and class of service given to the CM.

A number of miscellaneous trunks may be tested with MISC class. These trunks are similar to outgoing trunks in that they have route relay assignments. They differ, however, in that they do not have TT relays.

J1-8.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-8.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated MISC key or TSTB switch (MISC) in that chain extends the ground to the MISC relay which operates.

With the MISC key operated or the TSTB switch in the MISC position, operation of the ST relay operates the MISC relay. The operated MISC relay lights the MISC or STT lamp.

When the MISC or STT lamp lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the TKT relay allowing it to operate in series with the previously operated class-of-test relay MISC. The TKT relay operates the TKT1 relay which operates the TKT2 (SFD-J106). The TKT1 relay extends ground to the TT on the MG lead for later use to signal the TT to close a connecting relay to the MTFC (SFD-M208). The operated TKT1 relay furnishes resistance battery to operate N relay of the MTC which partially closes the path to operate the N1 relay. The TKT1 relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The N1 relay locks to ground on the KR relay normal, grounds the STG lead to the TT for operation of the ST relay of the TT (SFD-J108, J112) and closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-8.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-8.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided, to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR (key release) relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-8.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP (marker test preference) where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR (key release) relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-8.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller.

The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TMI relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TMI relay allowing the test call to proceed.

J1-8.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TMI relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TMI relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120,) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-8.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TKS relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTTS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-9 ITDO CLASS OF TRUNK TEST USING TRUNK TEST CIRCUIT

The M3 section of the SFD covers seizure of the TT circuit to test certain features of incoming trunks in a distant office. Sequence chart M304 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above tests. Paragraphs J1-9 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the TT and covered on sequence chart M304 have operated.

J1-9.1 GENERAL

The ITDO class of trunk test is used for testing certain features of incoming trunks in distant offices. A connection is established from the originating test line to an outgoing trunk. The call is devoted to a test line in the distant office. The TT relay of the outgoing trunk is operated but the TIP and RING leads are extended back through the trunk test multiple to the trunk facility. The CS lead from the trunk through the trunk TT relay and the trunk test multiple allows supervision from the distant end to be monitored.

J1-9.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-9.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated ITDO key or TSTB switch (ITDO) in that chain extends the ground to the ITDO relay which operates.

With the ITDO key operated or the TSTB switch in the ITDO position, operation of the ST relay operates the ITDO relay. The operated ITDO relay lights the ITDO or STT lamp.

When the ITDO or STT lamp lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the TKT relay allowing it to operate in series with the previously operated class-of-test relay ITDO. The TKT relay operates the TKT1 relay which operates the TKT2 relay. The TKT1 relay extends ground to the TT on the MC lead for later use to signal the TT to close a connecting relay to the MTFC. The TKT1 relay furnishes ground through the operated ITDO relay to operate the ITDO relay in the TT. The operated TKT1 relay furnishes resistance battery to operate N relay of the MTC which partially closes the path to operate the N1 relay. The TKT1 relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The N1 relay locks to ground on the KR relay normal, grounds the STG lead to the TT for operation of the ST relay of the TT (SFD-M308) and closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-9.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-9.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided, to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates

test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-9.4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-9.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller.

The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TM1 relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TM1 relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-9.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS2 relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120, J121) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-9.7 PREPARATION FOR TRUNK LINK AND TRUNK SELECTION

When the N1 relay operated in the MTC, it operated the TSK relay. The TKS relay with keys operated prepares the MTC to handle trunk selection in a specific way (covered in SFD-K3). The TKS with TS or NTFS key operated operates the KTS relay in the MTC. The TKS with the FS key operated operates the KFS relay in the MTC or if the NTFS key is operated the KMT9 operates in turn operating the KTS (SFD-J107).

J1-10 ITNP CLASS OF TRUNK TEST USING TRUNK TEST CIRCUIT

The M4 section of the SFD covers seizure of the TT circuit to test incoming trunks. Sequence chart M404 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above test. Paragraphs J1-10 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the TT and covered on sequence chart M404 have operated.

J1-10.1 GENERAL

The ITNP class of trunk test is used for testing incoming trunks. A patch cord connection is made from the trunk test circuit to the trunk under test. The marker is then directed to set a connection from the incoming trunk to the terminating test line. The TT thus has control of both ends of the connection.

J1-10.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-10.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated ITNP key or TSTB switch (ITNP) in that chain extends the ground to the ITNP relay which operates.

With the ITNP key operated or the TSTB switch in the ITNP position, operation of the ST relay operates the ITNP relay. The operated ITNP relay lights the ITNP or STT lamp.

When the ITNP or STT lamps lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the TKT relay allowing it to operate in series with the previously operated class-of-test relay ITNP. The TKT relay operates the TKT1 which operates the TKT2 relay (SFD-J106). Operation of TKT relay opens the ST ground path to prevent subsequent operation of ST key from shunting down the TKT relay. The TKT1 relay extends ground to the TT on the MC lead for later use to signal the TT to close a connecting relay to the MTFC (SFD-4089). The TKT1 relay furnishes ground through the operated ITNP relay to operate the ITNP relay in the TT. The operated TKT1 relay furnishes resistance battery to operate N relay of the MTC, which partially closes the path to operate the N1 relay. The TKT1 relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The TKT1 relay also grounds the STG lead to the TT for operation of the ST relay of the TT (SFD-M408). The ITNP relay opens the MTP lead to prevent the MTC from connecting to a CM through the MTFC (SFD-J106, J108, J112).

J1-11 SUBSCRIBER LINE TEST - CLASS OF TEST

The NO section of the SFD covers seizure of the master test frame voltmeter test circuit to test the subscribers line. Sequence chart N004 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above test. Paragraphs J1-11 of the SCD will discuss seizure of the MTC and MTFC and assume that relays found in the master test frame voltmeter test circuit and covered on sequence chart N004 have operated.

J1-11.1 GENERAL

The LT class of test is used to set up a connector from the master test frame voltmeter test circuit to any line to be tested. The MTC simulates a no-hunt incoming trunk that has an appearance on a trunk link. The MTC also simulates an incoming register and extends the trunk to the master test frame voltmeter test circuit where tests for talking, ringing, foreign potentials, capacitor tests, receiver off hook tone, and continuity tests may be made.

J1-11.2 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated LT key or TSTB switch (LT) in that chain extends the ground to the LT relay which operates.

With the LT key operated or the TSTB switch in the LT position, operation of the ST relay operates the LT relay. The operated LT relay lights the LT or STT lamp.

When the LT or STT lamps lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the LTI relay allowing it to operate in series with the previously operated class-of-test relay LT. Operation of LTI relay opens the ST ground path to prevent subsequent operation of ST key from shunting down the LTI relay.

The LTI relay connects the tip and ring leads from the MTC incoming trunk appearance on the trunk link frame to the voltmeter test circuit. Ground through normal relay in the voltmeter test circuit is extended through LTI relay in MTC operated to light the S lamp in voltmeter test circuit. The LT relay operates the MTCP relay in turn operating the PR relay (SFD-J107). The PR, with the LTI relay operated, completes the path to operate the NI relay (which checks AMRST and TT are normal). The NI relay closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-11.3 MASTER TEST FRAME CONNECTOR PREFERENCE

When the NI relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-11.3.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided,) to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-11.3.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-11.4 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RM1 relay (SFD-J123). The RM1 relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay.

circuit. Approximately 150 ms after the operation of the CIT relay, the TM1 relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TM1 relay allowing the test call to proceed.

J1-11.5 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TM1 relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TM1 relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-12 MARKER LINE VERIFICATION CLASS OF TEST

J1-12.1 GENERAL

The N1 section of the SFD covers connection to a CM to verify the cross-connections in the Number Group (NG) and class of service cross-connections in the LL for any line and for intercept and similar trunks to which an arbitrary class of service and line number has been assigned.

Sequence chart N104 makes reference to the J1 section which covers MTC and MTFC circuit paths that are used in the above test. Paragraphs J1-12 of the SCD will discuss seizure of the MTC and MTFC.

J1-12.2 REMOTE CONTROL

Remote control jacks are provided for use in connection with a 32A test set or the register test set in order that operation of the various circuits tested can be observed readily during a test call. These jacks are located on virtually all frames in the office. When a 32A test set

is connected to one of these jacks, the operation of the white button functions the same as the ST key for all classes of test, except LT class which makes the white button ineffective. The operation of the red button functions the same as the RL key on all classes of test. The buttons on the 32A test set are arranged so that they can be locked when desired. When the register test set is used, the ST and RL keys function the same as the corresponding keys on the MTC.

J1-12.3 START OF TEST (OPERATING ST KEY)

Operating the ST key operates the ST relay through break contacts of various test relays. This is to check that no other test call is in progress before starting another one. The ST relay operated extends ground to a test key or switch chain (SFD-J104, J105). The operated MLV key or TSTB switch (MLV) in that chain extends the ground to the MLV relay which operates.

With the MLV key operated or the TSTB switch in the MLV position, operation of the ST relay operates the LV relay. The operated LV relay lights the MLV or STT lamp.

When the MLV or STT lamps lights, the ST key may be released. Releasing the ST key releases the ST relay, which removes the shunting ground from the winding of the LV1 relay allowing it to operate in series with the previously operated class-of-test relay LV. Operation of LV1 relay opens the ST ground path to prevent subsequent operation of ST key from shunting down the LV1 relay. The LV relay operates the MTC relay in turn operating the PR relay (SFD-J107). The PR relay completes the path to operate the N1 relay (which checks AMRST and TT are normal). The N1 relay closes start battery to the MTFC (MTP) lead (SFD-J108, J112).

J1-12.4 MASTER TEST FRAME CONNECTOR PREFERENCE

When the N1 relay operates, it closes start battery to the MTFC (MTP) lead. The PCT lead is grounded to the traffic register which counts the number of tests made.

J1-12.4.1 Operating Marker Preference Relay (SD-25805-01)

Closure of start battery on the MTP lead to the MTFC operates a test preference relay MTP. If the MON relay is normal, the MTP relay operates the MTP1 relay and returns ground on the MKS lead when the MKT-preference chain is normal (SFD-J108). The MKS ground feeds through break contacts of normal marker selection keys MT(0-11) and through the make contact of the first operated MT(0-11) key (or through the selected position on the MT switch or MTU switch and MTT1 key, when provided,) to the corresponding MKT- lead to operate the MKT(0-11) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates

test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When no MT (0-11) key is operated or the MT or MTU switch is in the OFF position the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MT or MTU switches are set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J108, J109).

J1-12-4.2 Operating Marker Preference Relay (SD-27718-01)

Closure of the start battery on the MTP lead to the MTFC (SFD-J112) operates a test preference relay MTP where all preference relays are normal. Ground on the CIA1 lead (SFD-J115) extends back through make contact of the MTP relay to operate the MTP1 relay. The operation of the MTP1 relay operates the MTL relay (SFD-J119) which extends ground through normal contacts of the MKT- preference circuit and extends ground on the MKS lead (SFD-J112). The MKS ground extends through break contacts of normal MTU (marker selection) switches and through the make contact of the first operated MTU switch to the corresponding MKT- lead to operate the MKT(-) relay in the MTFC for the marker selected. The MTFC makes the marker service busy (SFD-J117) and, after verifying that the marker is test normal, operates test relays in the marker (SFD-J118), closes connector relays to the marker (SFD-J120), and grounds the TS lead to the MTC (SFD-J119). When the MTU switch is in the OFF position, the MKS ground operates the KR relay to restore the MTC and MTFC to normal. If the MTU switch is set to a position corresponding to an unequipped marker, the KR relay is operated to release the test call (SFD-J112-J115).

J1-12.5 SELECTION OF A MARKER

The MKT- relay in the MTFC connects ground to the MB lead to the marker to make it busy to subsequent service calls (SFD-J117) and operates the CIC and CIT relays (SFD-J118). The CIC relay operates the ON relay which locks (SFD-J122) and operates the RMI relay (SFD-J123). The RMI relay connects ground to the TRB leads to all markers except the one involved in the call, this path having previously been opened in the marker connector controller. The CIC relay also operates the RON relay (SFD-J118) which connects ground to the RON lead to each marker in order that the frame delay timing may be extended. The CIT relay closes another path for operating the ON relay.

At this point in the call it is necessary to determine whether or not the marker is engaged on a service call and if it is, to delay the test call connection until the marker has been released. A test of the MIT lead is made for this purpose (SFD-J117). Since the marker may be selected on a service call just as this circuit connects ground to the MB lead, it is necessary to delay the test of the MIT lead until sufficient time has elapsed to insure that ground has been connected to it under these conditions.

This delay is provided by a time delay circuit which controls the operation of the TMI relay (SFD-J118).

When the CIT relay operates (SFD-J117), it connects the marker MIT lead through MKT relay operated and the TS relay normal to the winding of the TM relay. The TM relay operates if ground is present on the MIT lead or if ground is connected to the MIT during the time interval. The CIT relay (SFD-J118) also operates the TMI relay through the time delay circuit. Approximately 150 ms after the operation of the CIT relay, the TMI relay operates and in turn operates the TS relay in the MTFC through normal contacts of the TM relay. If the TM relay is operated, it will delay the test call. If the TM relay is normal, the TS relay operates, locks through its own make contact and releases the TMI relay allowing the test call to proceed.

J1-12.6 SIGNAL TO CLOSE PATHS BETWEEN MTC AND MARKER

If the TM relay is normal when the TMI relay releases, or when the TM relay releases the marker preference relay is made ineffective and the test call is allowed to proceed by the TS relay in the MTFC. The TS relay locks to the CIT relay operated, removes ground from the TI recording lead, releases the TMI relay and connects ground to the TS lead to the MTC as a signal that the test may be started. The TS relay in the MTFC also operates the MT relay in the marker. The MT relay, with various keys operated, type of test being performed, and type of marker seized, operates appropriate MT- relays.

Ground on the TS lead operates the TS in the MTC which operates the TS1 relay. The TS1 relay operates the TS2-10 relays which operate the MC relay in the MTC (SFD-K102, K103). The TS relay closes ground on the CIB lead (SFD-J108, J112) from the MTC through an operated MKT- relay to operate MKB- and MKB1- relays. The MKB- and MKB1- operate the MTFC connector relays (SFD-J120) which close through leads required for a test call. The test proceeds under control of the MTC.

J1-13 MONITORING

Monitoring will be covered in SFD-10-01, Section P.

